Australian Government
Geoscience Australia

Positioning for the Pacific:
Good coordinates for good coordination

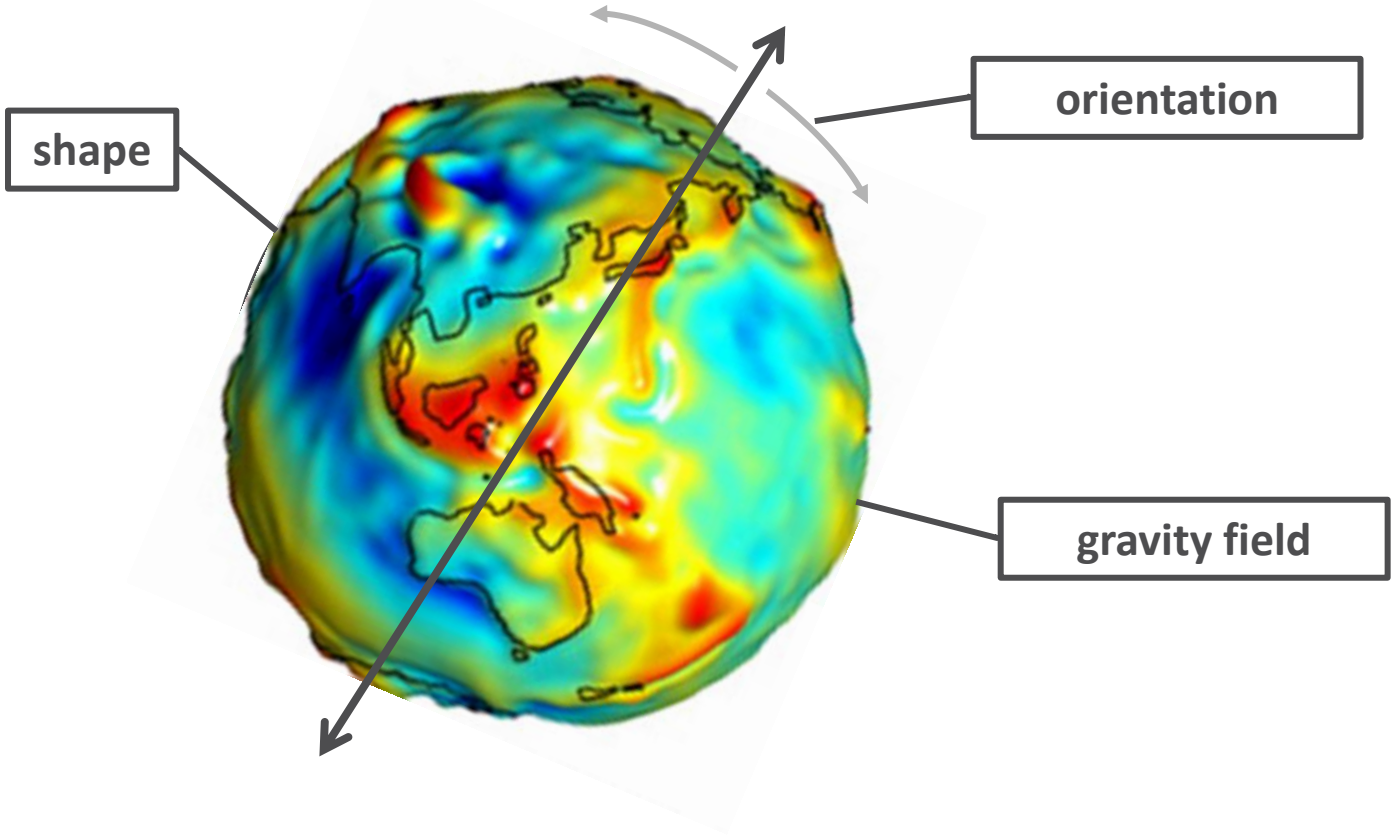
Nicholas Brown

Director of National Geodesy
Geoscience Australia

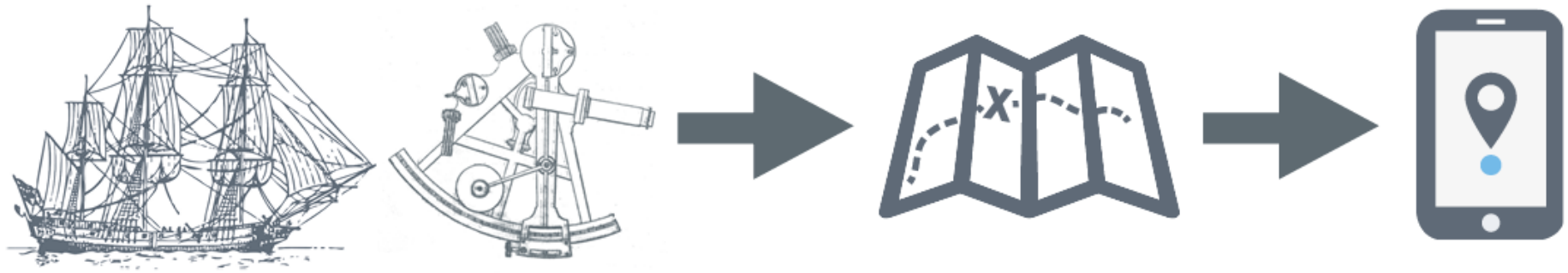
Geodesy

noun

*Science of measuring the **shape**, **orientation** and **gravity field** of the Earth and how it changes over **time**.*



Positioning has always been important



Downstream applications and benefits of precise positioning

~$1.1b

Adopting precise positioning technology in the mining industry was estimated to have increased output by $1 085 million in 2012 alone.

Mining

~$723m

Precise positioning technology in the construction sector was estimated to have increased output by $723 million in 2012.

Construction

~$466m

Precise positioning technology was estimated to have increased yields by up to $466 million in 2012.

Agriculture

United Nations General Assembly Resolution

GGRF - fundamental for monitoring changes to the Earth

The Global Geodetic Reference Frame is fundamental for monitoring changes to the Earth including the continents, ice caps, oceans and the atmosphere. It is also fundamental for mapping, navigation and universal timing.

The ability to position both information and objects accurately will be an increasingly important driver of productivity into the next decade.

Photo: Geoscience Australia

The Global Geodetic Reference Frame is a key enabler for monitoring disasters - and recovering from them.

Photo: Geospatial Information Authority, Japan.

Identifying areas under threat of flooding, earthquakes and droughts – and taking measures to counteract these.

Photo: Bjørn-Owe Holmberg

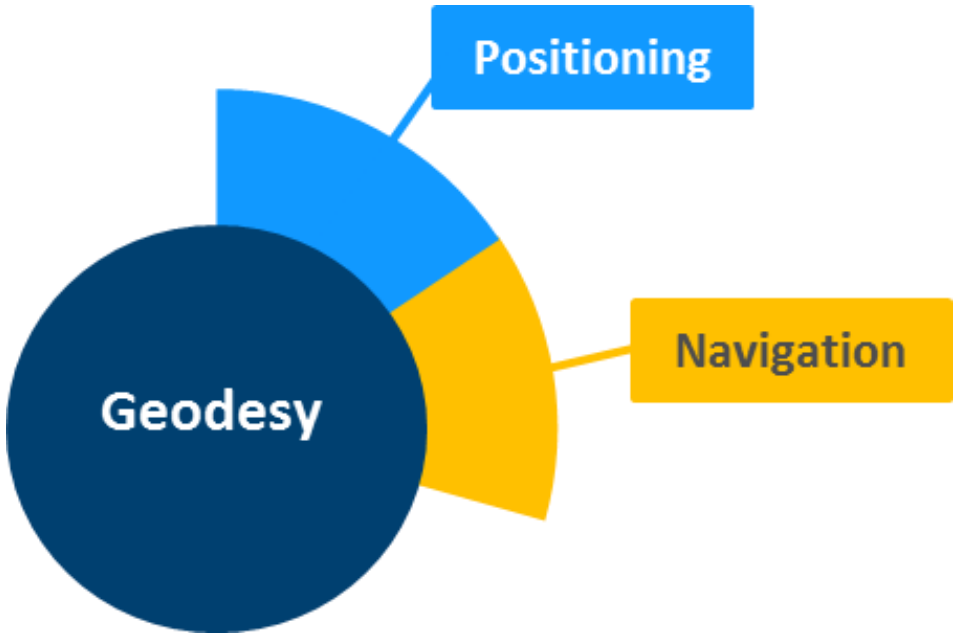
Monitoring sea level changes, plate movements, land uplift and ice sheet and glacier changes – so that global society can follow changes to the Earth system and plan accordingly on a local, regional and global level.

Photo: Anne Jørgensen

Good coordinates for good coordination

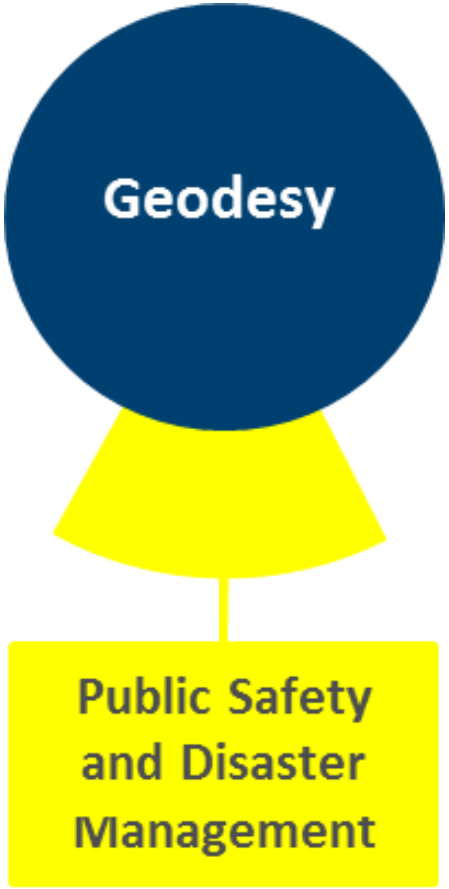
- Where am I?
- How far away are things I care about?
- How do I get there?

- How do I navigate ships safely through reefs?
- How can I compute and define maritime boundaries?
- How can I define the property boundaries within my country?
- How can I monitor and model the groundwater in the lens?
- How can I be sure to build the hospital above the flood warning level?
- How can I define the flood warning level accurately across a whole country at locations / islands that don't have a tide gauge?



Good coordinates for good coordination

- Earthquakes: detect strain build up in tectonically active regions
- Tsunami: observe environmental hazards to better understand them (e.g. Fukushima)
- Volcano: observations help detect the build up and release phase



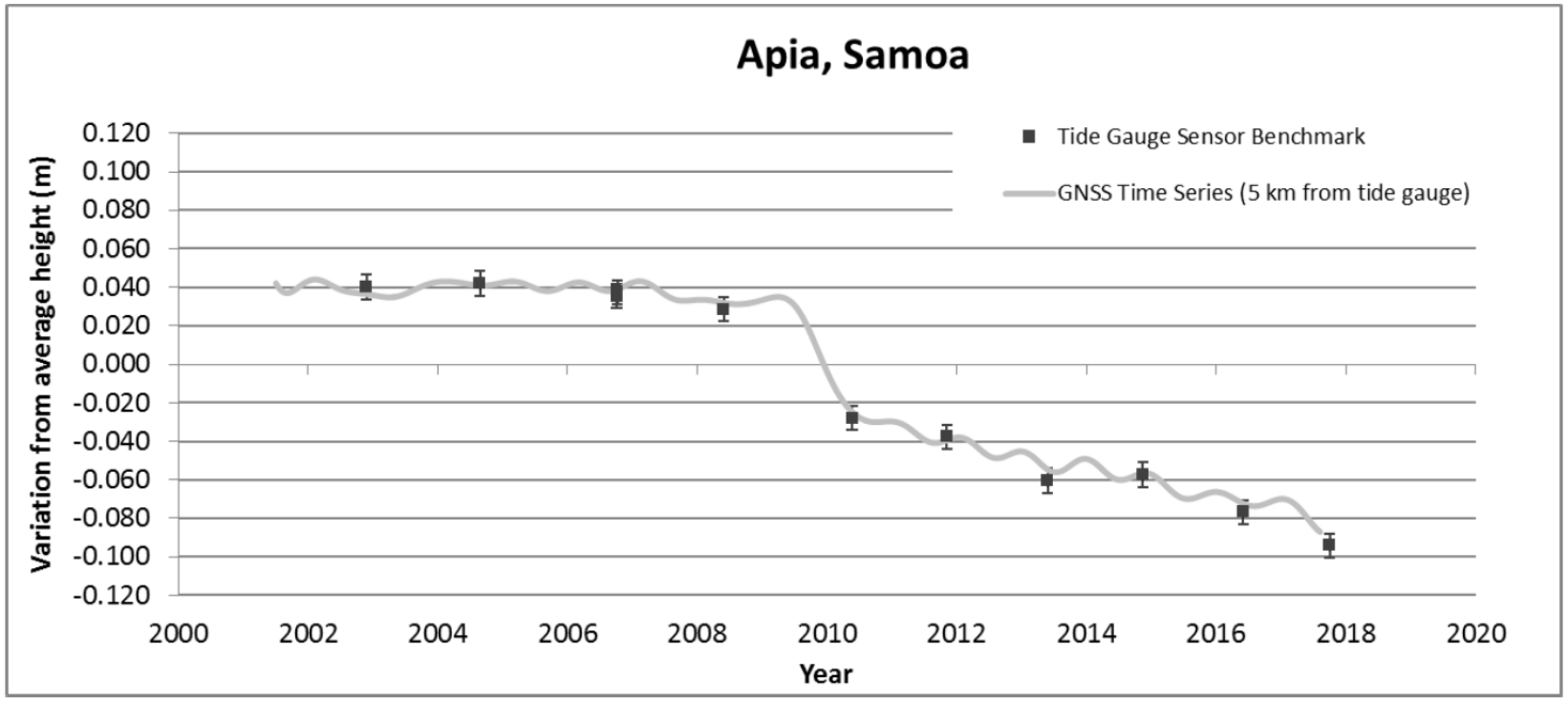
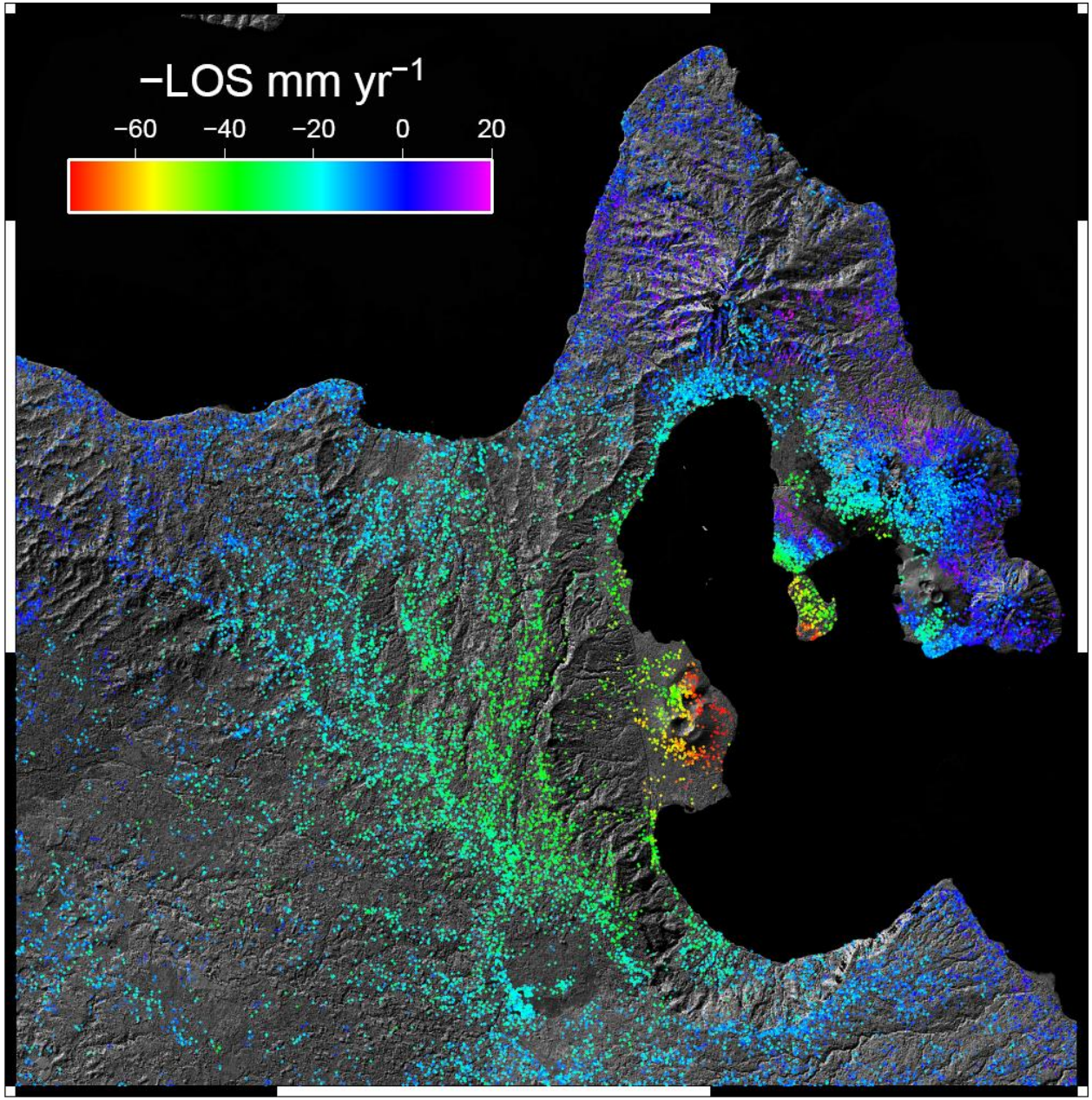
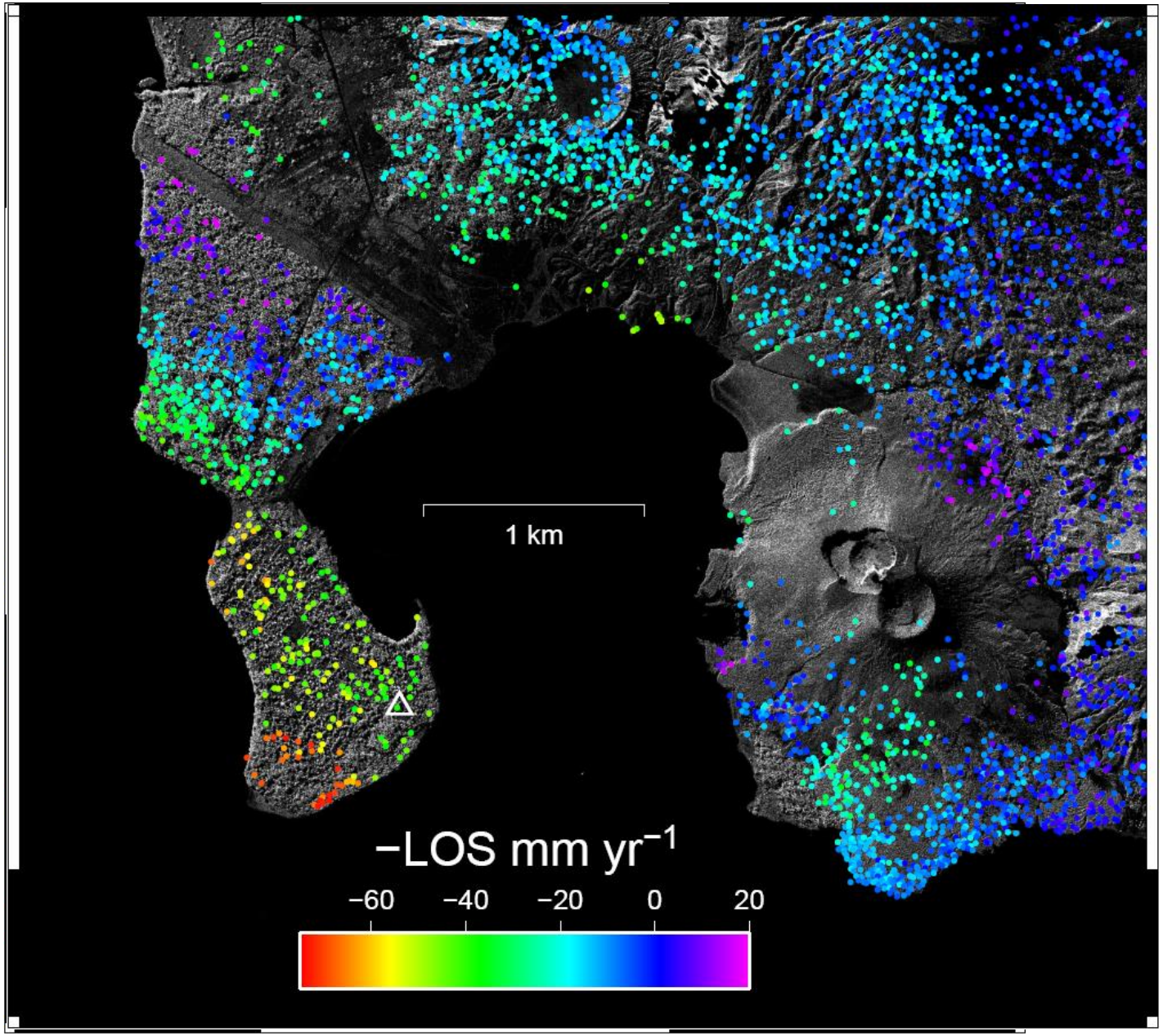


Figure: Ellipsoidal height of the tide gauge sensor benchmark (black squares) as determined from GNSS analysis (grey line) and the levelled height difference between the GNSS monument and the tide gauge.

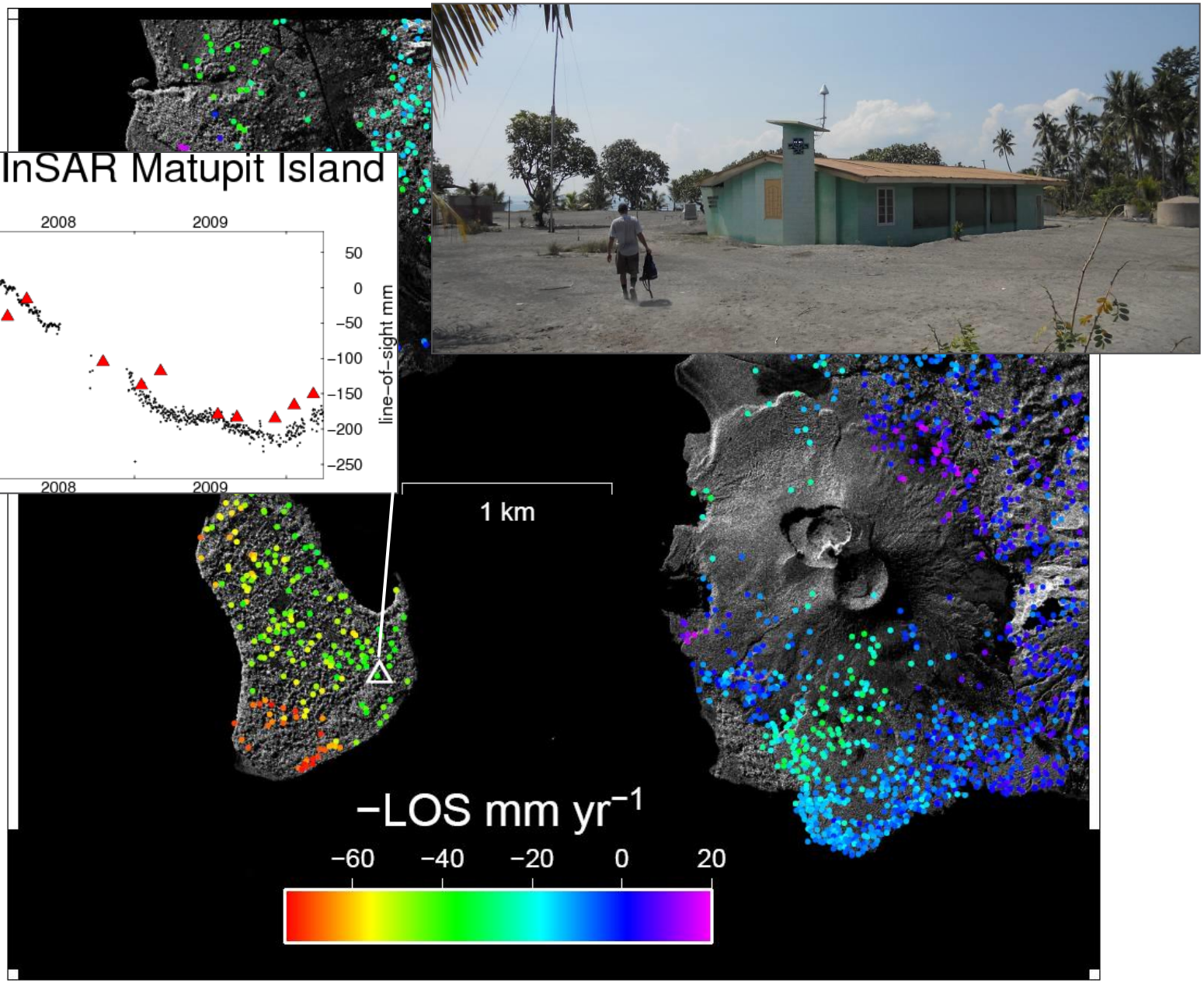
Results from all countries are available from:

http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/pacificsealevel





Dawson and Saunders, in preparation, 2011



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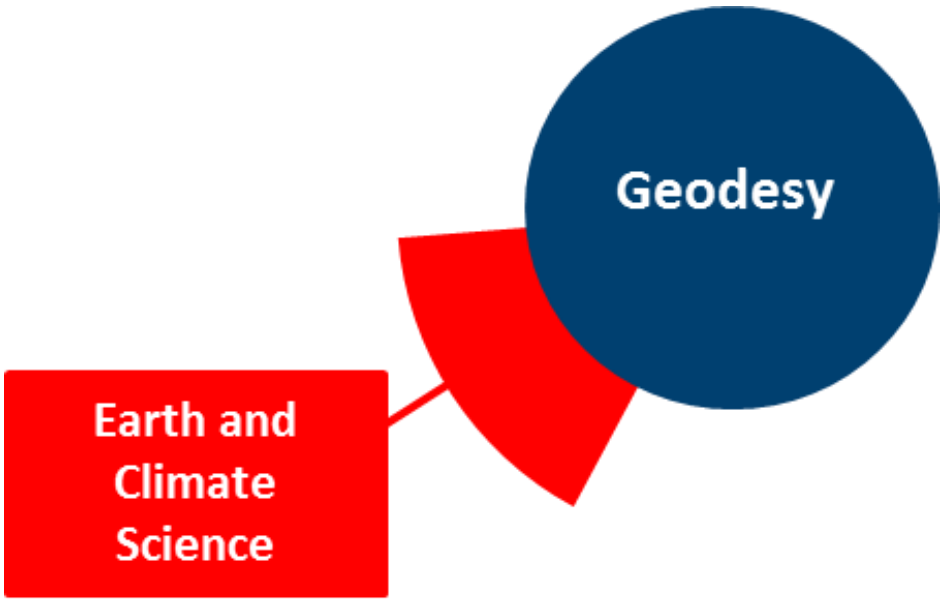
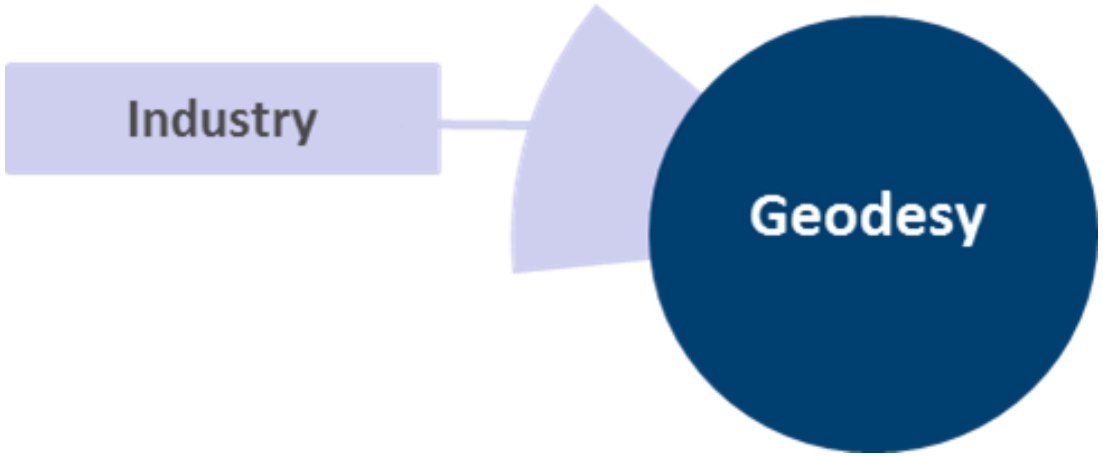


Satellites observations are able to detect millimetre scale trends in ocean and land height:

- Oceanography: changes in sea level from satellite altimetry and tide gauges
- Atmospheric: GPS can detect changes in the atmosphere for extreme events; GA data used for weather forecasting by BoM
- Groundwater changes: changes in gravity to map seasonal groundwater movement

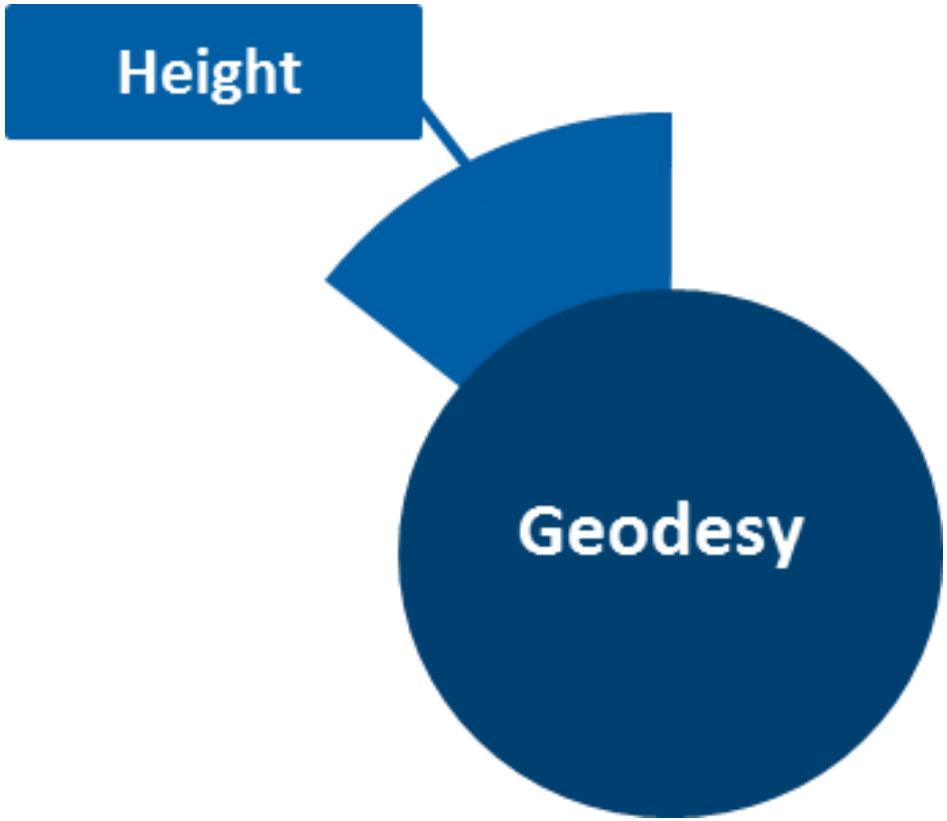
Good coordinates for good coordination



Construction and Engineering

- Installing and managing water, sewerage and telecommunication assets
- Bridges that meet in the middle
- Construction of houses and buildings in safe regions
- Monitoring information can help inform building codes
- Precise, efficient and increasingly cheap positioning capability.

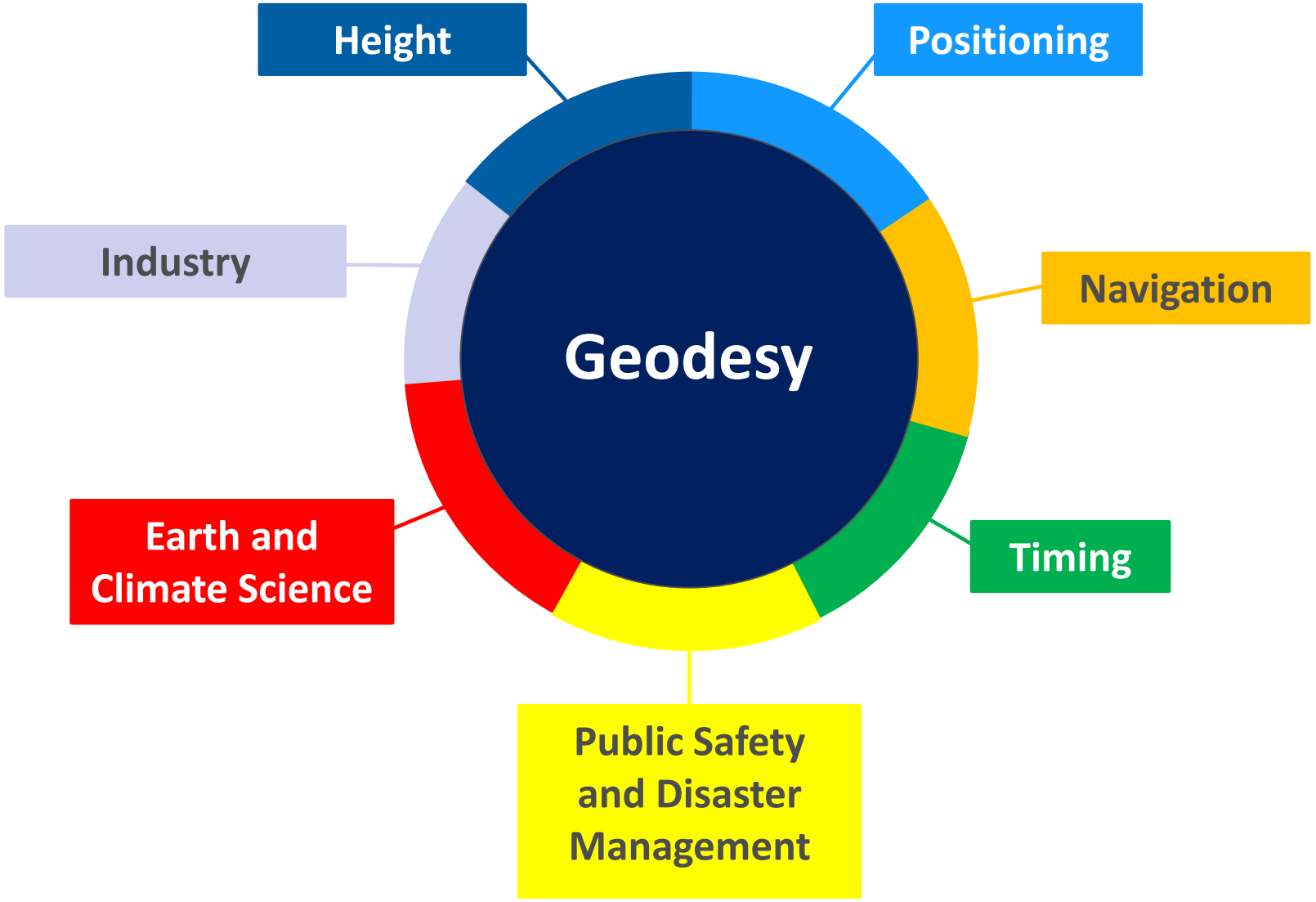
Good coordinates for good coordination



- Where should I build my house?
- Where should I go in case of a flood or tsunami?
- How can I mitigate the impacts of sea level rise?

- Pacific island nations have a need for improved height reference frame for planning, modelling, monitoring and mitigation.

Geodesy provides a foundation and framework for the collection, management and use of national geospatial information.



NPI NATIONAL POSITIONING INFRASTRUCTURE CAPABILITY

- Precise Positioning anywhere, anytime at centimetre level
- Improved access to GNSS data and products for existing and new industries

Positioning concepts

Accuracy
- How close is my Position to the ‘truth’?

Integrity
- Can I trust my Position?

Accessibility
- Is it cost prohibitive?
- Is it supported by user equipment?

Resilience
- How susceptible is it to spoofing and jamming?

Australasia Opportunity

Australia's Positioning Status

MOBILE COVERAGE

AUSTRALIA'S NETWORK OF **GNSS GROUND STATIONS**

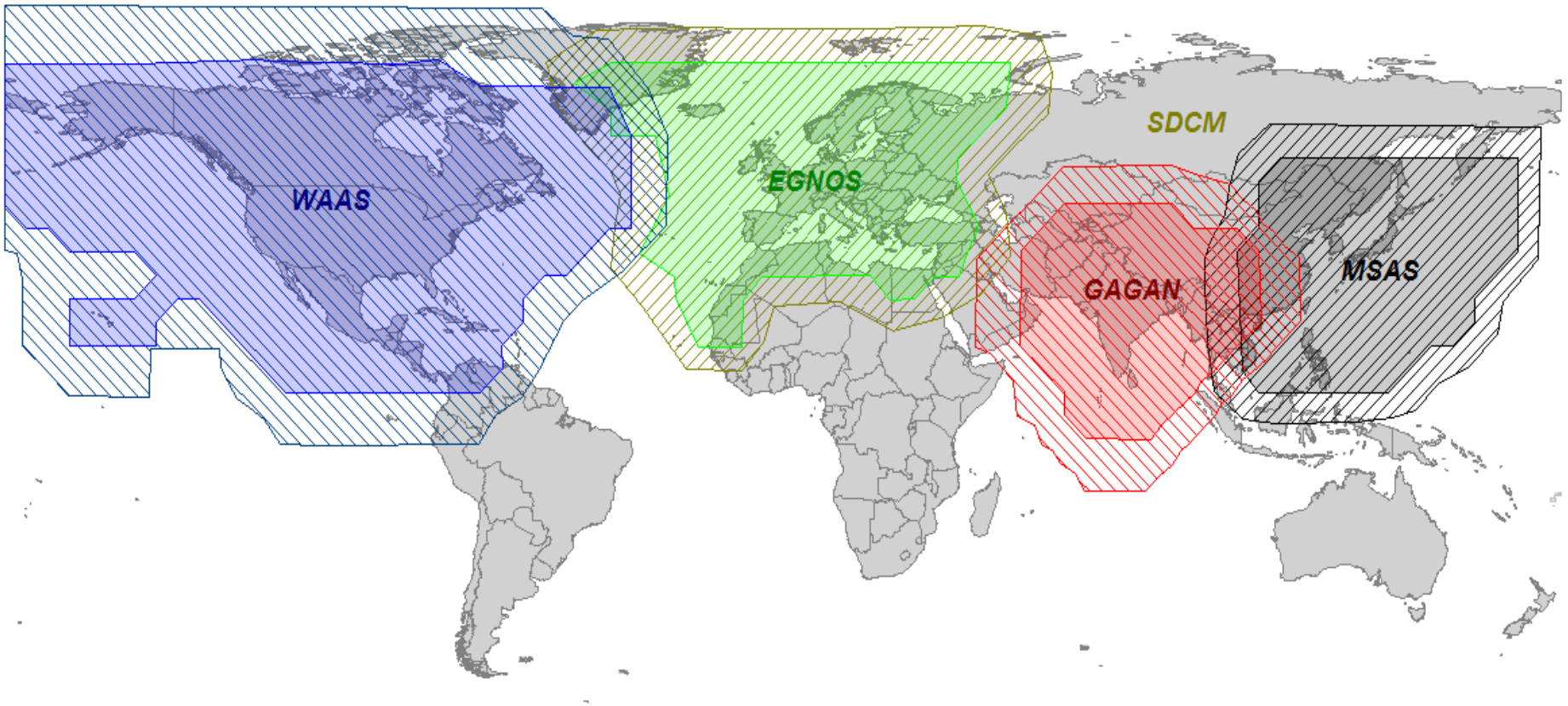
3 CENTIMETRES ACCURACY

IN AREAS WITH INTERNET/MOBILE COVERAGE

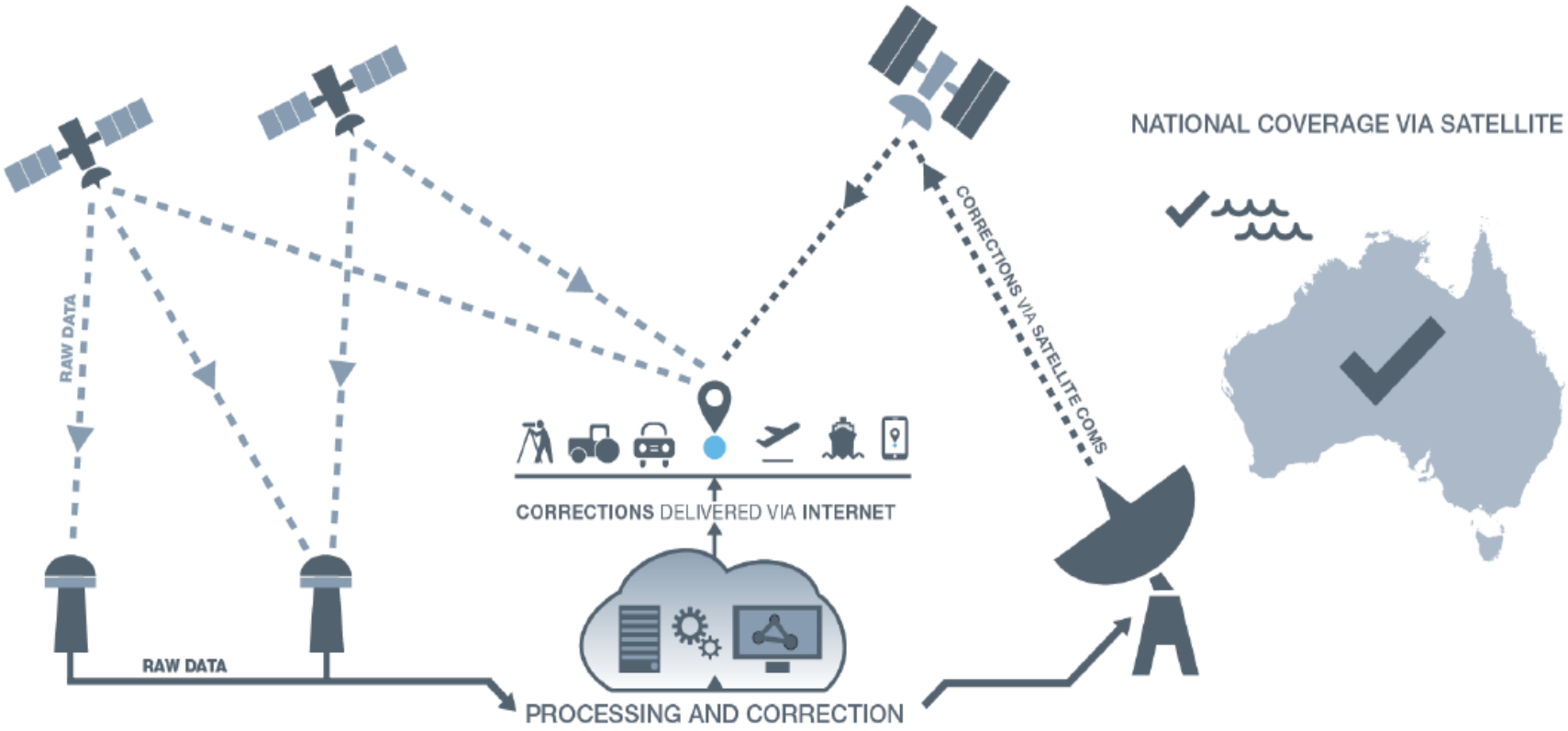
5 METRES ACCURACY

STANDARD SATELLITE POSITIONING

Global SBAS coverage



Satellite-Based Augmentation System (SBAS)



Budget 2018-19 – NPIC and SBAS

2018-19 Australian Federal Budget

- $225 M over four years implementation of NPIC including SBAS
- Ongoing operational budget

Planned outcomes

- 3 cm positioning within areas of mobile coverage
- Globally unique open infrastructure (multi-GNSS data and software)
- Greatly increased uptake of precise positioning
- More efficient industry and new businesses

Pacific Geospatial and Surveying Council

Sustainable development in the Pacific enabled by world class geospatial information and surveying services

Priorities:

1. Building the capacity of regional surveyors
2. Improving and standardising geospatial information gathering and dissemination
3. Maximising economic growth and alleviating poverty
4. Informing natural resource management, disaster risk management and climate change adaptation

Assistance for Pacific Island nations

1. Assistance with development of coordinate reference frames (horizontal and vertical) closely aligned with global navigation systems (e.g. GPS).
   - National strategic **and implementation plans**
   - Geodetic infrastructure
   - Analysis of data and datum development

2. Opportunity to access the SBAS system in the future for improved (cm level) positioning with additional benefits (e.g. integrity, resilience, cheaper access)